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BLOOD GROUPS AND INBREEDING IN SYRIA

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[2] The anthropology of the Near East is an intricate subject, but in view of the significance of the region for the prehistoric and early historic development of man, it is of importance. Rather than attempting to labor a point probably already conceded by most readers, we may simply refer to the remarks on this subject of Kappers and Parr ('34), Field ('35), Keith ('35), and Shapiro ('38).

Knowledge of the physical anthropology of this region, as Shapiro ('36) points out, is meager. In particular, few studies of characteristics known to be inherited in a definite way, such as "taste-blindness", or blood groups, have been [2a] made (compare Boyd, '39 b). We believe that our study (carried out in 1937 when one of us held a Guggenheim fellowship) on the incidence of the M,N types was the first to be made in the region covered by us.

[2] We were particularly anxious to determine the blood groups [3] of the Bedouin, previously tested for A and B by Shapiro ('35 b), and reported to be very high in group O, thus resembling some North American Indian tribes. Our results on the Bedouin tested by us did not support this picture (Boyd and Boyd, '38; Kayasi, Boyd and Boyd, '38), and we therefore desired to test also some villagers for comparison. Beit Mirrij seemed of special interest because it was known to represent a highly inbred population, and because a thorough sociological survey was being carried out there by Miss Anne Fuller. Mashghara was of interest as a typical mountain village, part Christian and part Moslem. We wished to test some Arme-

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nians because the M,N frequencies had never been reported for this ethnic group. Our attempt to test the Druze, a special religious group, unfortunately never resulted in a large enough sample to have any value, but the results are presented for the sake of completeness.

Our blood group results on two tribes of Syrian Bedouin have already been reported (Boyd and Boyd, '38). The other Syrian results are reported here. They include tests on about 131 individuals from Boarij, 306 from Meshghara (both towns in the Lebanon), 339 Armenians living in Beyrouth and nearby Ghazir, and an insignificant sample of Druze from 'Abadiya, not far from 'Aley, on the way up from Beyrouth to Damascus. In addition to determining the blood groups and types, we also recorded in a rough way degrees of hair, eye, and skin pigmentation, looked for hair on the second phalanx of the fingers, and tested for taste reaction to phenyl-thio-carbamide. These results are also presented.

Methods of preparation of the sera we used have been presented previously (Boyd, '39 a). Groupings were carried out by the test-tube method, as recommended by Landsteiner and by Schiff (compare Boyd and Boyd, '37; Boyd, '39 b). In each day's set-up bloods of known type were included, to check the activity of the sera. The anti-B, -M, and -N sera were preserved with acriflavine, and the anti-A with brilliant green, as recommended by Rosenthal (Boyd, '39 a). They were transported in stoppered bottles in a tin box, protected with rubber pads, which was kept on ice as much of the time as possible.

Taste reactions to phenyl-thio-carbamide were tested by means of filter paper impregnated with the substance, as described by Parr, one of the first to call attention to the anthropological significance of taste reactions to this compound.

We framed our questions to the subjects with considerable care, and frequently used blank paper to check the honesty of replies. We found our smattering of Arabic in general sufficient for this work, so that it was not necessary to depend upon interpreters for the patient's reaction to the test substance. The subjects were always asked to compare the taste, if they perceived one, to that of a substance known to them, and if

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they declared they tasted nothing, they were asked to consider 143
if they were tasting plain paper. They were tested one at a 125
time, to avoid suggestion so far as possible, and in places 151
where a high percentage were positive, enough blanks were interspersed among the tests to keep the rumour going about that some persons could taste this peculiar paper, while others could not. We also assured the patients in advance that no stigma, clinical or otherwise, attached to the ability or lack of ability to taste the substance. The work was of course less accurate, being carried out relatively hastily under "field" conditions, than a study made in the laboratory would have been. But we do not think that there are enough errors in our data to affect the percentages significantly.

Since our record of hair and eye color was incidental to the 142
blood grouping work, and usually had to be done hurriedly, 125
we adopted the simple plan of classifying by inspection all hair and eyes into four equal grades according to depth of pigmentation, ranging from the lightest "Nordics" to the darkest Africans. We planned to include in the first grade of hair blonds, ranging from albinos to Scandinavian blonds, in the second blonds and very light browns, in the third browns of different shades, in the fourth dark browns and blacks. In the case of eyes, grade 1 included the blues, 2 the dark blues and grays, 3 the "hazels" and browns, and 4 the dark browns and blacks. Of course such a classification is very crude, and we may unconsciously have varied our standards somewhat in different localities, but not enough, we feel, greatly to affect the results.

Degrees of skin pigmentation were similarly estimated: 1 signifies "white" skin and so on, up to 4 which includes the "blacks".

The presence or absence of hair on the second phalanx of 142
the fingers, inherited, according to Danforth, as a dominant, 143
was also observed rather hastily, to test if there were differ- 125
ences in frequency in different ethnic groups. The presence of even a single hair was taken as positive. Our results are probably only approximate (compare Boyd and Boyd, '37).

The results are presented in table 1.

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TABLE 1
Blood groups

PLACE	RELIGION	SUBJECTS	PER CENT OF GROUP				GENE FREQUENCIES			
			O	A	B	AB	p	q	r	D/σ
Boarij	Muslim	131	23.7	37.4	29.8	9.1	.295	.244	.487	1.1
Meshghara	Christian	107	29.0	35.5	28.0	7.5	.305	.217	.538	0.9
"	Muslim	199	44.7	40.2	11.6	3.5	.252	.061	.669	0.2
"	All	306	39.2	38.6	17.3	4.9	.256	.126	.626	0.8
Beyrouth and Ghazir (Armenians)	Christian	340	27.7	53.5	13.2	5.6	.375	.113	.526	1.3
'Abadiya	Druse	28	21.4	67.9	7.1	3.6	.482	.071	.463	0.4

Gene frequencies calculated by relations: $r = \sqrt{O/100}$,
$p = \sqrt{O/100 + A/100} - \sqrt{O/100}$, $q = \sqrt{O/100 + B/100} - \sqrt{O/100}$.
$D = 1 - (p + q + r)$, $\sigma = \sqrt{\frac{pq}{2\sqrt{(1-p)(1-q)}}}$

Blood types

PLACE	RELIGION	SUBJECTS	PER CENT OF GROUP			GENE FREQUENCIES		
			M	MN	N	m	n	D/σ
Boarij	Muslim	131	24.4	52.7	22.9	.508	.492	0.6
Meshghara	Christian	107	34.6	51.4	14.0	.553	.347	0.7
"	Muslim	199	28.6	52.3	19.1	.548	.452	0.8
"	All	306	30.7	52.0	17.3	.567	.433	1.0
Beyrouth and Ghazir (Armenians)	Christian	339	34.2	45.4	20.4	.589	.431	1.1
'Abadiya	Druse	28	53.6	39.3	7.1	.733	.267	0.6

Gene frequencies calculated by relations: $m = M/100 + MN/200$,
$n = N/100 + MN/200$, $D = 1 - (\sqrt{\frac{M}{100}} + \sqrt{\frac{N}{100}})$,
$\sigma = 0.5/\sqrt{V}$. (Compare Boyd, '38).

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Taste reaction to phenyl-thio-carbamide

PLACE	RELIGION	SEX	SUBJECTS	PER CENT POSITIVE OR NEGATIVE	
				+	—
Boarij	Muslim	Male	61	60.6	39.4
"	"	Female	58	75.9	24.1
Meshghara	Christian	Male	82	69.5	30.5
"	"	Female	14	71.4	28.6
"	Muslim	Male	115	79.1	20.9
"	"	Female	56	89.3	10.7
"	All	Male	197	75.1	24.9
"	"	Female	70	85.7	14.3
Beyrouth and Ghazir (Armenians)	Christian	Male	147	72.8	27.2
	"	Female	164	77.4	22.6
'Abadiya	Druse	Male	9	66.7	33.3
"	"	Female	15	93.3	6.7

TABLE 1—(Continued)

Hair on second phalanx

PLACE	RELIGION	SEX	SUBJECTS	PER CENT with	PER CENT without
Boarij	Muslim	Male	68	77.9	22.1
"	"	Female	61	55.7	44.3
Meshghara	Christian	Male	90	68.9	31.1
"	"	Female	16	50.0	50.0
"	Muslim	Male	129	58.1	41.9
"	"	Female	66	54.5	45.5
"	All	Male	219	62.6	37.4
"	"	Female	82	53.6	46.4
Beyrouth and Ghazir (Armenians)	Christian	Male	165	62.4	37.6
	"	Female	172	61.6	38.4
'Abadiya	Druse	Male	11	72.7	27.3
"	"	Female	17	58.8	41.2

Eye pigmentation

PLACE	RELIGION	SEX	SUBJECTS	PER CENT HAVING PIGMENTATION OF GRADE 1	2	3	4
Boarij	Muslim	Male	68	7.4	13.2	75.0	4.4
"	"	Female	60	10.0	20.0	68.3	1.7
Meshghara	Christian	Male	89	4.5	16.8	74.2	4.5
"	"	Female	17	5.9	11.8	64.7	17.6
"	Muslim	Male	142	10.6	13.4	69.7	6.3
"	"	Female	67	4.5	9.0	76.1	10.4
"	All	Male	231	8.2	14.7	71.5	5.6
"	"	Female	84	4.8	9.5	73.7	12.0
Beyrouth and Ghazir (Armenians)	Christian	Male	142	2.1	12.7	77.5	7.7
	"	Female	155	6.5	8.4	70.3	14.8
'Abadiya	Druse	Male	11	9.1	18.2	54.5	18.2
"	"	Female	17	0	0	70.6	29.4

Hair pigmentation

PLACE	RELIGION	SEX	SUBJECTS	PER CENT HAVING PIGMENTATION OF GRADE 1	2	3	4
Boarij	Muslim	Male	65	0	4.6	36.9	58.5
"	"	Female	58	0	0	79.3	20.7
Meshghara	Christian	Male	86	0	7.0	39.5	53.5
"	"	Female	17	0	17.7	35.3	47.0
"	Muslim	Male	124	0	9.7	50.8	39.5
"	"	Female	64	0	12.5	62.5	25.0
"	All	Male	210	0	8.6	46.2	45.2
"	"	Female	81	0	13.6	56.9	29.6
Beyrouth and Ghazir (Armenians)	Christian	Male	165	0.6	15.8	43.0	40.8
	"	Female	171	0	13.4	46.2	40.4
'Abadiya	Druse	Male	11	0	9.1	36.4	54.5
"	"	Female	15	0	0	33.3	66.7

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TABLE 1—(Continued)

Skin pigmentation

PLACE	RELIGION	SEX	SUBJECTS	PER CENT HAVING PIGMENTATION OF GRADE 1	2	3 - 4	
Boarij	Muslim	Male	68	55.9	41.2	2.9	0
"	"	Female	59	72.9	27.1	0	0
Meshghara	Christian	Male	90	71.1	28.9	0	0
"	"	Female	17	76.5	23.5	0	0
"	Muslim	Male	132	63.6	36.4	0	0
"	"	Female	67	70.1	29.9	0	0
"	All	Male	222	66.7	33.3	0	0
"	"	Female	84	71.4	28.6	0	0
Beyrouth and Ghazir (Armenians)	Christian	Male	166	36.7	62.7	0.6	0
	"	Female	173	50.3	49.7	0	0
'Abadiya	Druse	Male	11	63.6	36.4	0	0
"	"	Female	17	70.6	29.4	0	0

Since there are often sharp local variations in physical characteristics in Syria, we give our results separately for each locality investigated. Where more than one religious group was represented, we have subdivided our subjects on this basis also, as the barriers to mixture of different religious groups are still kept up, and there is some reason to suppose that different ethnic stocks may be represented in each to different degrees. This also enables us to look for the possible effects of inbreeding on the various characters.

DISCUSSION OF RESULTS

The results for the A,B blood groups are on the whole what was to be expected. The Armenian results show the high percentage of A found by previous workers (compare Boyd, '39 b). These individuals represent a recent influx into our area. We were informed that our subjects were mostly from Marash and vicinity, Turkey. In the case of the two Arab villages, it is rather surprising that the results for Boarij, where all are Moslems, should agree well with the results for the Christians from Meshghara, while the Christians and Moslems in Meshghara show a significant difference in blood group frequencies. It is our impression, however, that the

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It is our impression, however, that the Moslems in Meshghara represent the original population, while the Christians mostly represent a more recent immigration, probably from regions near the coast. The inhabitants of Boarij, and the inhabitants of Beyrouth tested by Parr ('31) show a per cent of group B somewhat in excess of that in the Moslems of Meshghara. It is somewhat difficult to test for the significance of this difference since Parr's results themselves do not seem to be altogether internally consistent. In any case, throughout the Near East, sharp local differences in racial characters can be observed, and are not surprising, in view of the intense conservatism of the local cultures.

Our A,B results for the Druze, doubtless because of the small size of the sample, do not agree well with those of Parr ('31); no significance can be attributed to this.

The results reported by Shanklin ('38) for the Bekaa and Alouites, whom he lists as mountain dwelling groups, are also different from each other, but perhaps not on the whole too different from our own.

The frequencies for the M,N types, the first to be reported for settled inhabitants of Syria, do not seem to present anything unusual. The M,N frequencies in Syrians and Armenians apparently do not differ notably from those in Europe, but do seem to differ from those in the only two tribes of Syrian Bedouin tested for M and N, where significantly low values of N were found (Boyd and Boyd, '38). We are inclined to consider this another example of the evolutionary effects of isolation (compare Boyd, '40). In M and N frequencies the Druze may resemble the Bedouin, for the χ^2 test indicates that the difference between the M,N frequencies of the Druze and the inhabitants of Boarij, for instance, is significant, in spite of the smallness of the samples. Of course, if the samples had been larger the difference might have been much less marked.

The taste reactions to phenyl-thio-carbamide show in every case the higher proportion of tasters among the females previously reported (Fisher and Brandt, '37; Boyd and Boyd, '37). The per cent of tasters is probably not significantly different in any of these villages from the results obtained for

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other Near-Eastern peoples (Parr, '34; Boyd and Boyd, '37). The whole Near East, if we may generalize from the still relatively scanty data at our disposal, seems to be relatively homogenous with respect to the "tasting" gene. Our results support a suggestion previously made by us that most of Parr's subjects were males.

It is still open to doubt if the presence of hair on the second phalanx is a simple hereditary character. In our previous report (Boyd and Boyd, '37 a), we mentioned that, although there was considerable variation in sex incidence, the racial variations observed were slight. On the whole, the same statement would also apply to our new data, but there is a suggestion that there is a higher incidence of mid-digital hair in Boarij than in Meshghara, for instance. Sewall ('39) found very few Eskimos had mid-digital hair, suggesting that strong racial differences may exist.

The grades of eye color found in the populations reported here are fairly consistent, with rather more light eyes than we found in Egypt. The hair pigmentation is on the whole dark, and it will be noted that in several cases there is a suggestion that the males are darker. A similar tendency was observed in some of the populations we reported in 1937. The skin is on the whole lighter than in Egypt, and again the males seem to be the darker. Greater exposure to the sun may be a contributing factor. The Armenians seem somewhat darker than the Syrians (compare Seltzer, '36). Our observations on Syrian pigmentation seem to agree roughly with those of Shanklin ('38).

Bedouin results. In addition to testing the blood groups of the Syrian Bedouin, we made other observations on them. The blood groups have been previously reported (Boyd and Boyd, '38), but it may be worth while to present here the other results, even though the conditions under which we had to work were such that our pigmentation, etc., figures for the Bedouin are less to be trusted (see table 2). The subjects were all males.

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TABLE 2

Results of observations for taste reaction to phenyl-thio-carbamide, mid-digital hair, eye color, hair color, and skin color on two tribes of Syrian Bedouin. In per cents.

TRIBE	SUBJECTS	TASTE REACTION +	TASTE REACTION —	TRIBE	SUBJECTS	MID-DIGITAL HAIR +	MID-DIGITAL HAIR —
Rwala	172	59.9	40.1	Rwala	19	44.8	55.4
Aqedat	53	62.3	37.7	Aqedat	8	41.4	58.6

TRIBE	SUBJECTS	EYE PIGMENTATION OF GRADE 1	2	3	4	SUBJECTS	HAIR PIGMENTATION OF GRADE 1	2	3	4
Rwala	201	0	1.5	86.1	12.4	179	0	1.1	40.2	58.7
Aqedat	72	0	11.1	79.2	9.7	63	0	1.6	36.5	61.9

TRIBE	SUBJECTS	SKIN PIGMENTATION OF GRADE 1	2	3	4
Rwala	196	7.1	47.5	45.0	0.5
Aqedat	73	8.2	47.9	39.7	4.1

The Bedouin taste results are not notably different from those of the city dwellers; there seems to be a somewhat lower incidence of mid-digital hair, the eye and skin pigmentation is definitely darker, the hair is perhaps somewhat darker. Allowing for the great differences in nomenclature, this difference seems to agree fairly well with that found by Shanklin ('35).

Perhaps our data, in spite of their crudeness, and the small numbers of subjects represented, will contribute to some small degree to a filling out of our knowledge of the distribution of pigmentation in this part of the world. The importance of systematic surveys of the frequency of individual genes, such as the "tasting" gene, is beginning to be appreciated (Boyd, '40).

Effect of inbreeding. It is not uncommon in anthropological papers to see differences between various local populations ascribed to inbreeding. It has even been suggested that "races" may be created by a process depending partly on inbreeding. It is likely that the word inbreeding, as used by some authors, has been corrupted from its correct genetical significance, and perhaps is really meant to be synonomous with endogamy, or something of the sort. As the geneticist uses the word, it means mating among close relatives. Others

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have remarked that actually the effect of inbreeding is transitory, in the sense that one generation of random mating would restore the population to the condition in which it started, so that the process can hardly have the importance apparently sometimes attributed to it (compare Boyd, '40). There has probably been a good deal of inbreeding in all of the villages studied by us. In the cases of Boarij, we are fortunate in having a sample of a population known to be relatively highly inbred. From a study carried out there by Miss Anne Fuller, we know that marriages between cousins are very common, as are consanguinous marriages where the relationship is less close. Almost the entire population of the village can be traced back to three or four family lines. The blood groups and the M,N types offer a means of checking the extent of the effect of inbreeding on the population.

It is known from genetics that the effect of inbreeding on a population is to increase the proportion of homozygotes and decrease the proportion of heterozygotes, and if the process is carried far enough, pure homozygous types will emerge in the same proportion (if selection or mutation play no role) as the frequencies of their genes in the original population (Robbins, '17).

With the M,N types, the heterozygote is type MN, and type M and type N are homozygous. If the inbreeding had modified these frequencies in the population of Boarij very much, we should find that type M and type N were relatively more numerous than would normally be found, so that we should have the relation:

$$\sqrt{M/100} + \sqrt{N/100} > 1$$

Actually, it may be seen from table 1 that in Boarij the heterozygote, MN, was slightly (but not significantly) in excess of the theoretical maximum of 50%, and we find

$$\sqrt{M/100} + \sqrt{N/100} = 0.972 < 1$$

Thus there is no evidence that inbreeding has increased the proportion of the homozygotes in the M,N types.

In the case of the A,B groups, the only group which is known a priori to be heterozygous is the AB group, which is

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always heterozygous. If inbreeding had modified the A,B groups notably, we should expect the frequency of group AB to be less than 2pq (the gene frequencies p and q are calculated from the frequencies of O, A, and B only). In fact, 2pq does give an expected percentage of group AB of 14.4 which is greater, but not significantly greater than the value found.

Whether a person of group A or group B is heterozygous or homozygous cannot be told readily except by test of his parents or offspring, or both, and even then the test will of course often be inconclusive, since human families are so often too small to give a sample of all the types of children an individual could produce. In our tests on the families of Boarij, we tested six families in which one of the parents belonged to group A or group B. In four of these families, the groups of the children proved the individual in question to have been heterozygous, a result which again does not suggest that the proportion of heterozygotes in the population of Boarij has been notably decreased by inbreeding.

As a rule when the anthropologist has invoked the concept of inbreeding, the exact genetic mechanism by which the character in question is determined has been obscure, so no test analogous to the above could be made. We venture to suggest that if in such cases tests could be made, inbreeding would be found not to be one of the major forces in the modification of the average local human population.[1]

SUMMARY

Tables showing the results of studies of blood groups, blood types, taste reaction to phenyl-thio-carbamide, mid-digital hair, and eye, hair, and skin pigmentation are presented for

[1] We are indebted to the officers of the Haut Commissariat in Beyrouth, and in particular to M. le Général Martin, for permission and encouragement to carry out this work; to Miss Anne Fuller, holder of the Margaret E. Maltby Fellowship of the American Association of University Women, 1937–38, for assistance and hospitality in Boarij; to the Trabulsi family for hospitality and assistance in Meshghara; and to Drs. Berberian and Kunstler for help with the Armenian work. Miss Nejla 'As-ed-Din put us in touch with the Druze village of 'Aludiya. Many others, too numerous to mention here, made our difficult task somewhat lighter. To all of them we extend our best thanks.

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the native inhabitants of three Syrian towns, and for Armenians now living in and near Beyrouth. Observations on the last five characteristics are presented for samples of two tribes of Syrian Bedouin. The effect of inbreeding on blood groups and types is discussed.

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